

OPERATING EXPERIENCE SUMMARY



Office of Nuclear and Facility Safety

December 2 – December 15, 1999

Summary 99-48

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OES 99-48 is the final 1999 issue. Production will resume in January 2000.

EVENTS

1. CHEMICAL EXPLOSION INJURES WORKERS

On December 8, 1999, at the Oak Ridge Y-12 Facility, workers were injured when an explosion of Sodium-Potassium (NaK) occurred. The workers were cleaning up a NaK spill that occurred in an arc melt furnace earlier in the month. The spilled NaK had previously been sprayed with mineral oil as well as being placed under an Argon gas blanket, to prevent oxidation until clean up. NaK is used as a coolant for certain arc melt furnace operations. During the clean up process, a violent reaction occurred. Eleven (11) employees were treated or observed for injuries. One of the employees was transferred to a special burn center in Chattanooga, Tennessee, and was listed in serious but stable condition. The employee received approximately twenty five percent (25%) total burns with 10% to 15% third degree burns. The employee also received contamination in his hair, which was removed prior to transport off site. Two employees were hospitalized in a local Oak Ridge medical center. The other injuries were not considered to require treatment off site. A Type "A" Investigation has been initiated and results will be published in a future summary. (ORPS Report ORO--LMES-Y12NUCLEAR-1999-0023)

2. NITROGEN DIOXIDE LEVEL ALARM TRIPPED DURING CATION REGENERATION PROCESS

On November 29, 1999, at Savannah River Site fuel storage facility, a high nitrite alarm tripped when vessel ventilation stack nitrogen dioxide levels reached the alarm setpoint of 230 parts per million during a cation resin regeneration process. The shift operating crew stopped regeneration activities, advised personnel to remain indoors, and notified facility management. The nitrite level continued to increase to a maximum of 650 parts per million. The stack alarm cleared 12 minutes after it tripped and nitrite readings remained in the 100 to 200 parts per million range for several hours before reverting to background levels. (ORPS Report SR--WSRC-RBOF-1999-0012)

Nitrite is a by-product of the cation regeneration process that uses both nitric acid and sodium hydroxide as key components. Nitrite is exhausted through the process vessel vent and analyzed for airborne concentration. Investigators determined that the probable cause of the event is a combination of several factors including the lack of agitation of the nitrite-based mixture as well as the delay in cation regeneration commencement following sodium hydroxide addition. They determined that this delay may have allowed sodium hydroxide to settle in the heel of the waste tank instead of being used in the regeneration process. Although there were no adverse safety or health problems and no radiological release, exposure to nitrogen dioxide fumes can be harmful to the respiratory and cardiovascular systems. The short-term exposure limit for nitrogen dioxide recommended

by the National Institute for Occupational Safety and Health is 1 ppm, with an immediately dangerous to life or health limit of 50 ppm.

EH has reported similar events. Some examples follow.

- On September 21, 1999, at the Lawrence Livermore National Laboratory, a hazardous waste management contractor was sprayed with a slurry of Raney nickel when the cap on a hazardous waste container blew off. Approximately 2.5 ounces of the slurry was released, spraying the contractor and the ceiling. He was preparing waste containers for shipment to an off-site waste disposal facility, and violated procedures by adding water to the container. The water reacted with the Raney nickel releasing hydrogen and pressurizing the container. Raney nickel is a finely-divided alloy of nickel and aluminum, suspended in water. This event is significant because improper handling of hazardous chemicals can cause serious personnel injury. (ORPS Report OAK--LLNL-LLNL-1999-0045)
- On October 28, 1997, personnel at the Savannah River Site reported the inadvertent release of nitrogen dioxide from a process vessel vent stack at the Receiving Basin for Offsite Fuels. An engineer saw a yellow-brown vapor rising from the stack and, believing this was abnormal, reported it to the facility manager. Operators were regenerating resin at the time the release was discovered. They terminated the process after the engineer reported seeing the vapor, and the discharge from the vent stopped. Investigators determined that an operator had added more reactant to a waste tank than the procedure specified on the previous day. This reacted with nitric acid from the regeneration process and produced nitrogen dioxide. Although there were no adverse safety or health problems and no radiological release, exposure to nitrogen dioxide fumes can be harmful to the respiratory and cardiovascular systems. (ORPS Report SR--WSRC-RBOF-1997-0012).

These events highlight the importance of workers properly following procedures in order to duplicate expected results when working with chemicals. In facilities where hazardous chemicals are handled, workers should stop work whenever the specific hazards of handling, mixing, and storing these chemicals has not been fully assessed. Facility managers should emphasize the importance of researching all available sources of chemical safety information, particularly when performing first-time or infrequent operations. Information about chemicals, chemical hazards, and chemical safety programs are located on the DOE Office of Environment, Safety and Health, Office of Worker Safety, Chemical Safety Program home page. The home page is located at http://tis-hq.eh.doe.gov/web/chem_safety/. It provides links to many sources of information, including requirements and guidelines, lessons learned, chemical safety networking, and chemical safety tools.

KEYWORDS: operations, procedures, chemical reaction

FUNCTIONAL AREAS: Operations, Procedures, Training and Qualification

3. FAILURE TO RECONNECT WASTE TRANSFER JUMPER CAUSES RADIOACTIVE WASTE SPILL

On December 1, 1999, at the Hanford Site, a high radiation waste leak detector was activated when a technician failed to reconnect a jumper during a saltwell waste transfer. The jumper is located in a below-grade diversion box. Facility management stopped waste transfer operations and performed a subsequent saltwell flush, thus tripping the detector a second time. Facility management then canceled waste transfer operations and, when they confirmed that the location of the leak in the diversion box was near a waste transfer pump, placed administrative locks on the transfer pump. There were no injuries associated with this event. Radioactive waste spills can cause exposures to personnel and the environment. (ORPS Report RP--LMHC-TANKFARM-1999-0019)

Investigators determined that the transfer line was disconnected and not subsequently reconnected when completing work the previous day. They determined that the transfer structure contains several pipeline connection points to facilitate multiple transfers into the receiving tank. The technician took photographs to document each step and used reach rods and impact wrenches to remotely manipulate the connections while a quality control specialist used the photographs to verify that each step was successfully implemented. Investigators determined that the technician became distracted and did not seek clarification when he could not identify the letters on one of the nozzles. He proceeded to start the transfer pump before reconnecting one of the jumpers and approximately 10 gallons of high-level radioactive waste spilled onto the diversion box floor before facility management shut down operations.

This event underscores the importance of operators maintaining questioning attitudes and paying attention to detail to ensure configuration control is maintained. Configuration control is important to ensure safe operation, testing, and maintenance of facility equipment and systems. In addition, if operators had correctly performed independent verifications, this event could have been prevented. Operators should be trained in the importance of questioning attitudes and attention to detail. They also must be trained in how to correctly perform independent verifications. Workers should also be trained to stop work and report as-found conditions that are inconsistent with expected conditions.

KEYWORDS: work planning, work control, waste transfer

FUNCTIONAL AREAS: Work Control, Work Planning

4. DRILL PENETRATES CONDUIT CONTAINING ENERGIZED 120-V WIRING

On December 2, 1999, at the Pacific Northwest Nuclear Laboratories, an electrician was drilling a hole through a floor when the drill penetrated an electrical conduit containing energized 120-V wiring. The internal portion of the conduit and the wires were damaged, but there were no injuries. The electrician was core drilling a two-inch hole for a new conduit, and had marked the location of the penetration, but incorrectly measured the location of the conduit mounted under the floor. When the electrician realized he had hit the electrical conduit, he stopped work and notified his supervisor. Fuses protected the circuit and de-energized the conductors. Although no injuries occurred in this near-miss

event, penetrating energized electrical utilities can result in serious injury, equipment damage, and disruption of facility services. (ORPS Report RL--PNNL-PNNLNUCL-1999-0017)

Investigators determined that the electrician knew there was a conduit on the other side of the floor, but relied on the measurement from the underside of the floor to locate the drill point on the top portion of the floor. The worker who marked the drill location did not place it in the correct location. The only personal protective equipment required for the work were dust coveralls and leather work gloves. Investigators determined that there was a known electrical conduit on the under side of the floor, and that a water cooling system was used for the drill. Unfortunately, a drill stop device¹ that de-energizes the drill when metal is detected near the drill bit was on order.

In a related event, on November 24, 1999, at the Savannah River Analytical Laboratory, personnel performing a core drilling operation struck an energized electric line. The drill shut off when the ground fault interrupter opened the circuit. No injuries were reported when the conduit was breached and the energized cable was not damaged. (ORPS Report SR--WSRC-ALABF-1999-0021)

EH has reported other events in the OE Summary where energized electrical service was contacted while drilling and cutting walls and floors. Some examples follow.

- OE Summary 99-25 reported that pipe fitters at the Pantex Plant penetrated a conduit containing energized 480-V ac circuits while core drilling a wall. Investigators determined that the pipe fitters mis-located the conduit on the opposite side of the wall when they placed their mark for drilling. (ORPS Report ALO-AO-MHSM-PANTEX-1999-0042)
- OE Summary 99-17 reported that craftsmen at the Mound Plant penetrated a conduit containing four energized 110-V ac circuits while core drilling a concrete floor. Investigators determined that the craftsmen did not have a permit for core drilling. The permit would have required personnel with utility locating equipment to scan the area for hidden utilities. (ORPS Report OH-MB-BWO-BWO03-1999-0001)
- OE Summary 99-07 reported that telecommunications technicians at the Rocky Flats Environmental Technology Site drilled into two energized 120-V electrical lighting circuits while installing a telephone line in a trailer, causing two 20-amp circuit breakers to trip. Investigators determined that the integrated work control package failed to require the use of a utility locator before drilling to determine if electrical wiring was present in the trailer wall or the installation of a lockout/tagout if the technicians determined wiring was present. (ORPS Report RFO--KHLL-779OPS-1999-0007)

The PNNL event illustrates the importance of accurately measuring and marking not only the location of the penetration or the cut, but also the location of any obstructions. The safest course of action when an electrical service is involved is to have it de-energized and

¹ One drill stop device is manufactured by DRILLCO, model DS-69A. The stopping is accomplished in 5 microseconds, and can handle voltages up to 600V. The device is intended to sense the presence of grounded metal in concrete and prevents damage to the metal by terminating power to the drill. Further information can be obtained by contacting Mr. Larry Musen (DOE-RL) at (509) 372-4009.

locked out. As an added precaution, workers should use double-insulated tools, rubber mats, electrically rated gloves, and ground-fault circuit interrupters for power tools. Facility managers and work planners should review the following references when planning penetration work.

Lessons Learned Report, Issue 98-02, *Penetrating Hidden Utilities*, includes lessons learned from events that involved cutting and drilling into utilities concealed behind walls, floors, and ceilings. It also provides recommendations for avoiding hidden utilities and includes useful references. Some of these recommendations include (1) checking drill holes frequently for signs of obstructions, (2) stopping to investigate if an obstruction is hit, (3) marking the location of utilities, (4) and using drills equipped with electronic drill stops.

29 CFR 1926.416(a)(3), *Protection of Employees*, states that employers shall ascertain by inquiry, direct observation, or instruments whether any part of an energized electrical circuit is located such that the performance of work may bring any person, tool, or machine into contact with it. OSHA regulations define concealed wiring as "wiring rendered accessible by the structure or finish of the building." OSHA regulations are available at http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc.html.

KEYWORDS: conduit, electrical hazard, energized equipment, near miss, penetration, wire

FUNCTIONAL AREAS: Construction, Industrial Safety

5. TRANSPORT OF OFFSITE HAZARDOUS CHEMICALS

On November 22, 1999, at Pacific Northwest National Laboratory (PNNL), research staff and safety technicians discovered that hazardous, incompatible and explosive chemicals had been improperly transported as unregulated materials. The chemicals were discovered when the staff unpacked an off-site consignment of laboratory materials and equipment. The improper packaging resulted in violations of DOE and DOT transportation safety procedures. Although no injuries occurred, the capability was not available to mitigate an accident due to an absence of proper safety barriers.

(ORPS Report RL--PNNL-PNNLBOPER-1999-0033)

A newly hired senior scientist moved his personal materials and equipment from his previous work location, using a commercial moving company. Investigators determined that the procedures of PNNL do not adequately cover transportation of laboratory materials and equipment for new hires. They determined that the transferred scientist did not communicate adequately with PNNL's move coordinator, nor with the commercial moving company's professional representatives regarding the need for special packaging and separation of hazardous and incompatible materials. They further determined that the shipment included incompatibles packed together without proper separation, and a required placard was not placed on the transport vehicle.

The investigators determined that PNNL's safety staff plan on implementing the following actions for enhanced transportation safety.

- Unpack and log all the chemicals into the Laboratory's Chemical Management System.
- Ensure that the additional inventory does not exceed the building's storage limit.
- Mitigate the explosive material hazards.
- Develop a new procedure for management of laboratory moves.
- Inform the moving company of their transportation violations.

EH has reported similar occurrences, where hazardous and incompatible materials caused or created potential for personnel injuries, because transporters did not follow correct DOE and DOT transport procedures. Following are some examples.

- OE Summary 99-03 reported that a subcontracted private waste disposal facility notified the Idaho Nuclear Technology and Engineering Center (INTEC) waste shipping group that a 30-gallon drum of hazardous waste that INTEC had shipped to the subcontractor's facility was not correctly labeled. The subcontractor determined that although the drum contained 40 liters of waste with a pH of 0.86, it had not been labeled as corrosive waste. A check of facility records associated with the shipment containing the drum indicated that INTEC had not neutralized the waste before shipping it from the site. Although there were no adverse consequences from this occurrence, incorrect waste characterization can result in wastes being handled improperly, which can cause personnel injury or environmental damage. Incorrect waste characterization can also lead to fines by state and federal regulating agencies. (ORPS Report ID--LITC-WASTEMNGT-1999-0004)
- OE Summary 98-18 reported that at the Hanford Pacific Northwest National Laboratory waste management workers discovered waste that had been incorrectly characterized and shipped over public roads. The waste was shipped as non-RCRA (Resource Conservation and Recovery Act) regulated low-level radioactive waste (DOT Hazard Class 7) instead of corrosive waste (DOT Hazard Class 8). Investigators determined that the waste generator supplied incomplete data on the contents in one of two 5-gallon waste containers and that waste-sampling procedures were inadequate to accurately characterize the pH of the waste in both containers before shipment. Although there were no adverse consequences from this occurrence, incorrect waste characterization can result in wastes being handled improperly, which can result in personnel injury or environmental damage. Incorrect waste characterization can also lead to the potential for fines by regulating state and federal agencies. (ORPS Report RL--PNNL-PNNLBOPER-1998-0004)

These events underscore the importance of properly characterizing materials and clearly communicating the information to shippers and processors to ensure that hazardous, incompatible substances and radioactive materials are handled to prevent environmental release or personnel injury.

DOE O 460.1, *Packaging and Transportation Safety*, establishes safety requirements for packaging and transporting off-site shipments from DOE and for on-site transfer of hazardous materials. Hazardous material shipments are required to be in compliance with DOT hazardous materials regulations in 49 CFR 106-199, *Transportation*, and the applicable tribal, state, and local regulations not pre-empted by DOT.

DOE O 460.2, *Departmental Materials Transportation and Packaging Management*, establishes DOE policies and requirements to supplement applicable laws, rules, regulations, and other DOE Orders for materials transportation and packaging operations.

KEYWORDS: shipment, hazardous, incompatible materials

FUNCTIONAL AREAS: Chemical Safety, Packaging and Transportation Safety

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